

Suppression of Cyclotron Instability in ECR ion Sources by Two-frequency Heating

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Multiple frequency heating is one of the most effective techniques to improve the performances of ECR ion sources. The method increases the beam current and average charge state of the extracted ions and enhances the temporal stability of the ion beams. It has been recently demonstrated that the appearance of the periodic ion beam current oscillations in ECRIS at high heating power and low magnetic field gradient is associated with kinetic plasma instabilities. The present study demonstrates that the stabilizing effect of two-frequency heating is connected with the suppression of electron cyclotron instability in ECRIS plasmas. Experimental data show that the interaction between the secondary microwave radiation and the hot electron component of ECR ion source plasmas plays a crucial role in mitigation of the instabilities.